The Glass Industry
REG. U. S. PAT. OFF.

Vol. 14 AUGUST, 1933 No. 8

"Glass is a Salt"

(Le Verre est un sel)[1]

By F. W. Preston

THERE seems to be an extraordinary confusion in the minds of most glass workers as to what glass is. This is particularly true of technical men, and the more technical they get, the worse definitions they give of glass. The man in the street, whose only interest in glass is a hope that his windshield wont shatter, seems to have a clearer idea of the nature of glass than the chemists who devote their lives to it.

Among the many unsatisfactory notions which we hoped were now dying down is the statement, still occasionally given, that "glass is a *salt*", consisting of acid and basic radicles in combination. This definition will hold water about as well as a colander.

It will be generally conceded that acid and basic radicles in combination do not necessarily make a glass. Thus calcium oxide as a base, and sulphur trioxide as an acid radicle make calcium sulphate. This may be a powder (plaster of paris) or, with the aid of a little water, a crystalline substance (gypsum); in either case it is a salt, but in neither case is it a glass.

It does not help to specify that the acid radicle shall be silica or boric oxide, and the bases soda or potash.[2] For silica and soda may be combined to form sodium disilicate crystals, and then we have a salt, but we do not have a glass. For on one thing even the most confused are agreed, that if a substance is palpably crystalline, it is not a glass. The terms "crystal" and "glass" are in chemical and physical language, mutually exclusive, though unfortunately not in industrial usage.

However, the question is not whether "salts" are "glasses", but whether "glasses" are "salts": that is, whether glasses are a special variety of salts, "salt" being a general term intended to include both crystals and glasses, and also many liquids.

It is generally agreed that fused silica is a glass: it is further agreed that B_2O_3 is not known, in the cold state as anything but a glass Thus the acid radicles themselves can form glasses in the absence of bases, and such glasses are evidently not salts.

Further, the ordinary glasses of commerce are all more acid (higher in silica) than the most acid crystal compounds which contain any base at all. Thus, in the well-known and much quoted system, Soda-Lime-Silica, the most acid sodium silicate crystal is sodium disilicate, $Na_2O.2SiO_2$; the most acid calcium silicate crystal is Wollastonite.$CaO.SiO_2$; and the most acid compound of the three oxides is Devitrite. $Na_2O.\ 3\ CaO.\ 6\ SiO_2$. And our commercial glasses are more acid than any of these. Thus the best that could be said of our glasses along the lines of the "salt" definition is, that they are solutions of salts in an acid.

Such a concept has frequently been used by chemists, not so much by way of definition, as by way of providing a picture or hypothesis. As a definition it would break down, because the *salts* are not necessary to the *solution*. We reduce the "salts" to the vanishing point and are left with the "solvent," pure silica, which can be still a glass all by itself, as previously stated. Further the "solvent" may be taken away and a glass formed, by appropriate manipulation, from the remaining "salts", in many cases.

The plain fact of the matter is, that a glass is not a chemical substance, but a physical state. A "salt" is a chemical substance. A glass is a particular condition which some chemical substances can assume. If these substances take on the glassy condition, they are then themselves called glasses.

Thus, a glass cannot be defined in chemical terms. The word "salt" is a chemical term, and a chemist, as a chemist, has no means whatever of determining whether a substance is a glass or not. Only physical tests can distinguish whether a substance is a glass: the microscope and polarscope, not the test tube, decide the point.

[1] Jacques Wolf. Le Travail du Verre. Brussels, 1932.
[2] Loc. cit.

How is Glass-Lined Steel Equipment made and Where is it Used?

How do they put the glass lining inside huge steel tanks? This is a question that is often asked about glass-lined containers made by The Pfaudler Co., Rochester, N. Y. In short, the "glass lining" is in reality a highly silicated glass enamel coating which is fused into the steel at high temperatures, but that is another story.

This product has had a 50 year development and was conceived at a time when the world was living largely in a "wooden age." Common metals of today were comparatively high priced and impractical in that period. The introduction of glass enameled steel equipment came as a corollary to the development of a new method of handling beer. Mr. Caspar Pfaudler conceived the idea of applying a vacuum to wooden tanks containing beer in the "ruh stage," the purpose being to remove the carbonic acid as rapidly as it developed, in order to complete the fermentation of the beer in a shorter time The inability to use wood, because it would not hold a vacuum, required the use of some other material.

Over half a million dollars was spent in developing vacuum-proof containers; first, a paper-coated barrel, then stone, terra-cotta, cast iron, and even glass containers, before the idea of applying glass enamel to a steel tank was successfully accomplished. Eventually a glass enamel was developed which could be applied to steel and cast iron and from that time on, glass enameled steel equipment has rapidly found its place in the many branches of the food and chemical industries.

In the manufacture of this equipment, big sheets of steel are cut to specified sizes, sheared, rolled into rings and joined together by electric welding. Steel heads are pressed and welded to the rings, after which the use of the oxy-acetylene process is applied on the inside of the tank. The largest tanks measure 10 feet in diameter by 14 feet in depth.

After welding is completed, the weld lines are ground down by a power grinding wheel to insure a surface as smooth as the tank proper. The interior of the tank surface is then sandblasted and after meeting a rigid inspection, the container is ready for the application of the glass enamel.

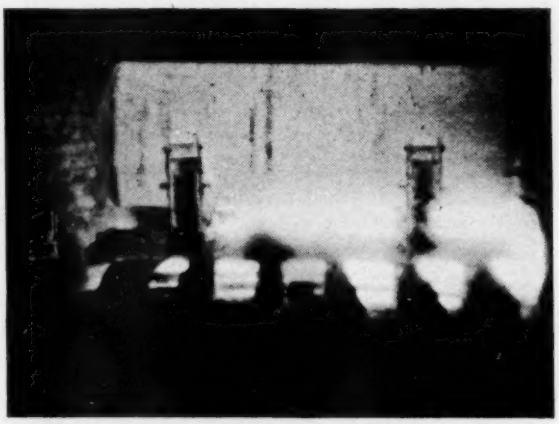
Twenty-nine minerals, some of them imported from Iceland, are used in making this enamel. It is sprayed wet on the inside surface of the tank and during the drying period it is closely guarded to prevent anything from touching the sprayed surface.

The coated tank is then taken by a huge crane which places the tank in a direct coke fired furnace where it is burned from 30 to 45 minutes at temperatures ranging from 1400 to 1800 degrees F. Under this heat, the enamel fuses to the steel and upon cooling presents a smooth, shiny glass-like finish.

Many types of equipment are built, ranging in design from storage tanks of varying capacities to complicated mixers, reaction kettles, distillation units, vacuum cookers and even glass-lined pipe and fittings.

Anyone familiar with the history of the brewing industry is aware that with the introduction of Pfaudler glass-lined steel tanks, breweries of such large proportions as Anheuser-Busch, Inc., Jacob Ruppert, Inc., Schlitz Brewing Co., Pabst Brewing Co., Liebmann Brewing Co., August Wagner & Sons, and hundreds of others, were made possible. At the present time, The Pfaudler Co.'s plants at Rochester, N. Y., and Elyria, O., are working full capacity to keep up with the huge demand that came with the legalization of 3.2 beer.

Notable progress has been made in other fields, particularly in the last 20 years.



3000 GAL. HORIZONTAL TANK IN FURNACE WHERE GLASS ENAMEL HAS JUST BEEN FUSED TO STEEL AT "WHITE HOT" TEMPERATURE.

The dairy industry is a large consumer of all types of glass-lined equipment, including modern glass-lined tank cars and truck tanks for hauling milk, ice cream mix, candy filler, beer, wine, etc.; glass-lined milk pasteurizers, ice cream mixers, automatic milk pasteurizers.

Those who know the problems of the food manufacturer appreciate what tremendous change has taken place in the commercial production of foodstuffs. Great emphasis is placed upon the retention of natural food flavors, color and quality. The susceptibility of most vegetables and fruit products to spoilage from both bacterial and metallic contamination, lead to the extensive use of glass-lined equipment for making fruit preserves, tomato juice, ketchup and canned tomatoes, mayonnaise, soups, vanilla extract, and many kindred products.

When it comes to the chemical industry, resistance to acid is of primary importance. With the exception of hydrofluoric acid, which attacks all glass, this glass-lined equipment is used for all acids at various concentrations and at elevated temperatures and pressures. Manufacturers of C. P. chemicals, pharmaceuticals, cosmetics, drugs, etc., have found in this equipment the solution of their highly corrosive operations.

(*Continued on page 87*)

(*Continued from page 86*)

The applications for glass-lined equipment are almost limitless, but the foregoing represent the basic uses. Every year hundreds of special applications are encountered too numerous to mention in this brief description.

Viscosity of Optical Glass

Research Paper No. 577 in the July number of the Bureau of Standards Journal of Research is a report of an investigation of the viscosities, at high temperatures, of six optical glasses— light barium crown, borosilicate crown, soda-lime, and dense medium, and barium flint glasses. A concentric-cylinder type viscometer, an electrically heated furnace, and porcelain stirrers and crucibles were used. For a limited number of tests the porcelain was protected with platinum.

The driving torque was produced by masses of known weight, and the time required per revolution was measured with a stop watch automatically started and stopped. Temperatures were determined by means of four platinum to platinum rhodium thermocouples.

Preliminary to work on glass, determinations were made of friction corrections and certain factors, including the so-called "end effect," were evaluated. The method of producing and testing constancy of rotational speed is described. The classical equation for viscosity, when using an ideal concentric cylinder viscometer, was modified to fit the apparatus used. The paper sets forth methods for the derivation and correction of the miscellaneous factors involved.

Viscosity values were determined for each glass in the temperature range 900° to 1,400° C. (1,652° to 2,552° F.), and equations are given expressing the mathematical relations of viscosity to temperature. A brief discussion of the viscosity changes resulting from volatilization of the glass and its reaction with the crucibles and stirrers, and of the consequent difficulty in determining the exact composition of a glass at the time the test is made, is included.

Removing Paraffin From Glass

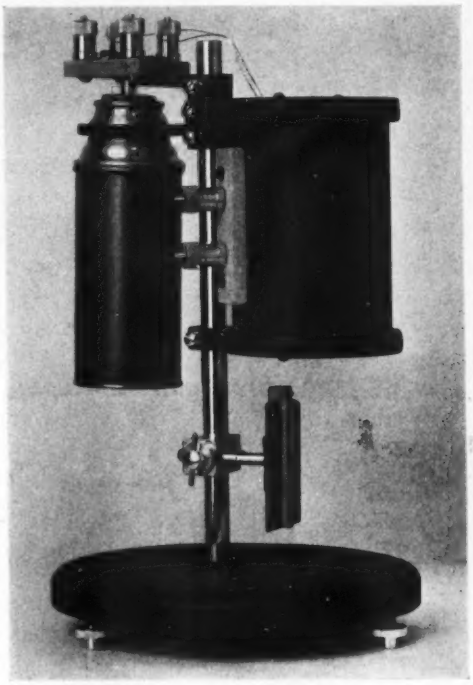
In making the qualitative test for fluorine by etching a design on a paraffiin-coated watch-glass, the most tedious part of the procedure is the ensuing removal of the paraffin. This is usually done by scraping off the major portion with a knife-blade or spatula and scouring off the remainder with chloroform or carbon tetrachloride. This often temporarily fills up the etching (if any) with paraffin, so that the result of the test is in doubt until the last of the paraffin is removed (particularly if the etching is faint) and much time is consumed.

A much quicker and more satisfactory method is as follows:—One of the holes of the steam-bath is opened and the watch-glass inserted into the atmosphere of live steam with a pair of crucible tongs. The paraffin immediately melts, most of it runs off, and the glass is quickly removed and polished while still hot with a dry cloth, thereby removing the last trace of paraffin and revealing at once the presence or absence of etching. The entire operation consumes but a few seconds. *The Chemist Analyst.*

Bailey & Sharp Bring Out New Tool

A new tool has been made available to glass manufacturers by the Bailey & Sharp Company of Hamburg, N. Y., who are offering the trade a standard furnace for measuring the softening temperature of glass. In essential points the furnace follows the specifications given by Dr. J. T. Littleton to the American Ceramic Society. However, for convenience and economy a built-in cold-junction and a base-metal thermocouple are employed.

The instrument may be used in control work for a daily check up on the glass to see that no alterations in composition have occurred, or it may be used to ascertain



the effect of changes in composition on low temperature viscosity. It may also be used to distinguish glasses from one another, when the glasses differ in softening point but may be similar in other easily measured properties. It affords a simple means of comparing the workability of one glass with that of another.

An important feature is that all the furnaces will be identical in dimensions. This will permit comparisons of determinations made in different laboratories, something that would be impossible if a standard design were not adhered to.

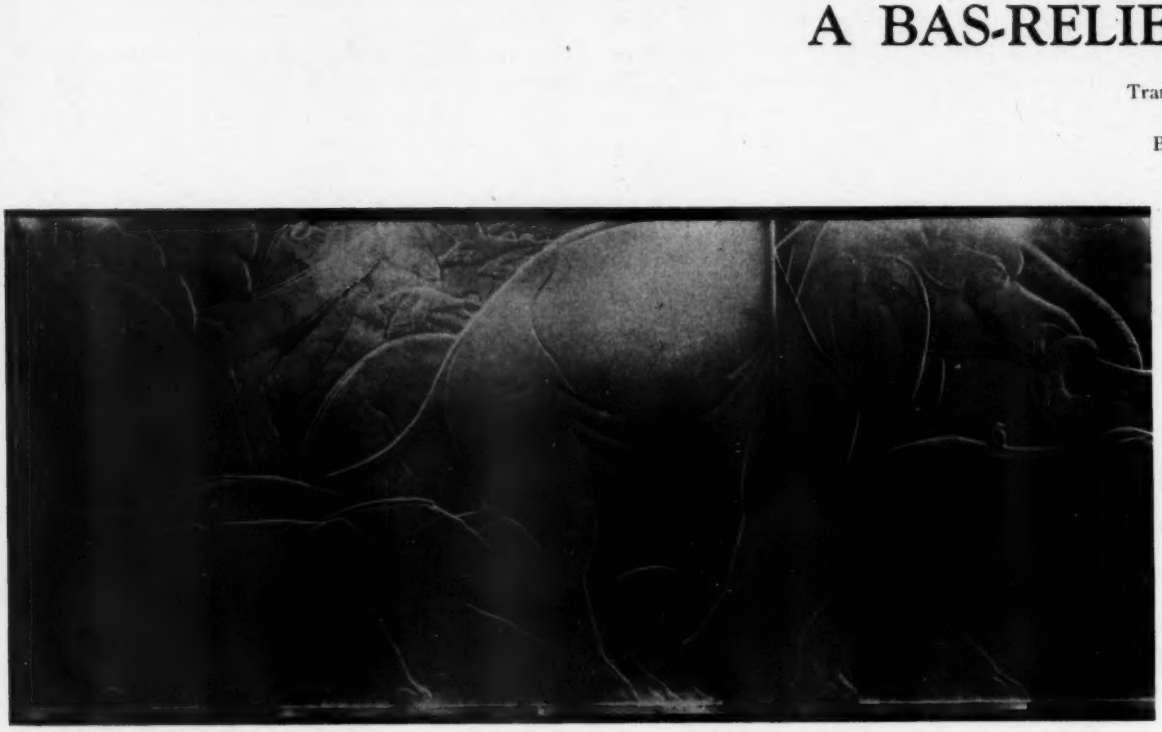
Colored Structural Glass

The Marietta Mfg. Corp. of Indianapolis, Ind., recently issued a new booklet describing their new product which has been named Sani-Rox, which is adapted to use for store fronts, office building lobbies, banks and similar public institutions. It is furnished in large slabs in various colors including black, white, blue, jade, ivory, grey, green, yellow and orchid. It is also made in sandblasted decorated form.

A BAS-RELIEF IN W

Translated from *Gl[illegible]t Ve*

By Courtesy of [illegible]irecto



IN THE Hunting and Tourist Pavilion[1] of the African Territories under French mandate (Togo and Cameroun) we have found an admirable work of art in a large bas-relief in wrought glass representing a series of animals that appear to be pursued, made luminous by surface lighting, which attracts one's attention by the irridescence of the material and the pure lines in the design. There is no retouching by paint, varnish or color. The glass is alone in its purity. It was thought that this magnificent piece was worthy of being treated by itself.

The work of cutting the glass with a sand jet was done in accordance with the process of Mr. di Lauro on three beautiful polished slabs 36 mm thick, 2.25 m high and 3.33 m wide. Placed side by side, they form a monumental frieze 10 meters long.

It certainly seems as if the "di Lauro artistic glass" has opened a new possibility for decoration and architecture. To our knowledge a bas-relief of this size and of this excellence has never before been made, with such skill. One feels the importance of this "massive" but "translucent" architectural element that gives a strong impression of relief because of the deep cuts that hold the light.

These crude or polished slabs, that are of unchangeable material, form the basis for the architectural and luminous decoration. One may expect to see them on the outside of the building, replacing the window railings, or in the pediment, forming a fitting crown for the edifice.

[1]At the French Colonial Exposition in 1931.

This is also an interesting solution of the frequent problem of a presentation clearly seen in daylight and luminous in the evening.

When congratulating Mr. di Lauro, we asked his advice in regard to the possibilities and the future of engraving on glass and mirrors.

"Glass engraved with sand and acid" stated Mr. di Lauro, "enjoys and will continue to enjoy well-deserved favor. Unfortunately it has been discredited, in the eyes of the public, by many productions that are poor both in composition and execution. In these productions, there seems to be increasing use, to a deceitful and ignorant extent, of varnishes and highly colored enamels, but do they accomplish the desired purpose? Do they diffuse light in the glass or in interiors? And these additions of the precious metals, gold and silver, used in so-called 'rich' decorations, are they justified? We do not hesitate to say No. These devices are used most frequently to hide poor composition, expression and lack of depth of interest.

"The methods of grinding, or making a design on a background appear transparent, translucent or opaque are well known, but such is not the case with decoration and accurate creation to fit the function of the object. An architect once told us that too much is done to put etching on the basis of a 'trade' so that the object could be placed on the front of a shop, in an interior, on the ceiling, on a sign, on a piece of lusterware, and not enough attention is paid to making engraved glass an intimate part of the architectural work or a part of the decorative scheme.

IN WROUGHT GLASS

om G... *Verres*, June, 1931

sy of ...irector, R. Lhote.

"It must be said that this situation is due, to a great extent, to excessive purchases by many who are content with inferior quality. As a means of counteracting this tendency, our 'artistic glass' has made it possible to produce some noteworthy pieces both for special collections and for certain architects and decorators, with their valuable assistance."

Mr. Ferguson's Translations of German Articles

Mr. F. C. Flint has complained for some time past that English-speaking authors give a minimum of attention to German literature on glass, and that German writers give scant attention to the work of English-writing technologists. In consequence, there have been growing up two independent sets of literature, and two distinct schools each following their own tradition. With the increasing mass of detail, the two schools have less and less time to attend to each others results or ideas.

The language difficulty is a serious one. Few technologists are good linguists, and even if they were, time does not permit the reading of more than a fraction of what is published. We imbibe most of our ideas from the general atmosphere of our surroundings, rather than from specific reading.

As a partial palliative, Mr. Flint has organized a group to finance the translation of a modest number of German articles into English: the translations are made by Mr. R. F. Ferguson of Pittsburgh, mimeographed, and circulated by the American Ceramic Society to those who subscribe to the fund for the purpose.

Some useful articles have already appeared, and the translations are above the average. The cost is small, and the results illuminating. The divergence of German and English thought is already very apparent, and we hope the movement may lead to a better understanding of it.

F. W. PRESTON

Ananias Club

A statistician, we are told, is a man who helps figures to lie when they do not naturally lie of themselves.

In the September issue of the *Journal of the Society of Glass Technology,* Francis Flint has a paper on Statistical Methods of Testing Bottles.

Be it known, therefore, to all whom it may concern, that Francis Flint is for this offense, elected a member of the Ananias Club.

Previous members are Frank W. Preston, for his story of the six-foot Australian angle worms (proposed, seconded and carried unanimously by the aforesaid Francis Flint), and J. T. Littleton for an equally harmless story at Woodmont (proposed, seconded and carried unanimously by Francis Flint and Sam Bowman).

Further be it known that Aaron Lyle, for collaborating with said Francis Flint in said paper on Statistical Methods, is placed with Roy Blunt on the waiting list for the Ananias Club.

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Reference to the contents of earlier issues of THE GLASS INDUSTRY can be found in THE INDUSTRIAL ARTS INDEX in many Public and Technical Libraries.

Code

With his usual straightforward and confidential manner President Franklin D. Roosevelt talked to his national audience via radio July 25 explaining the Industrial Recovery Program and more specifically Blanket Code.

His invitation to American industry to voluntarily join the movement to increase employment by shortening hours and to establish a minimum wage throughout the country should start the move now deemed necessary toward his Industrial Recovery Program, especially in view of the fact that many industries have not as yet come forward with their "codes."

So far as the glass industry is concerned no definite steps have yet been taken toward the completion of a code although many ideas have been submitted and are being considered at this time. With speedy action as an essential to the entire Recovery Program it is hoped that a glass industry code will be ready for submission shortly.

New Beer in Old Bottles

The practice of putting new wine into old bottles was ridiculed in Palestine exactly nineteen hundred years ago, but the practice of putting new beer into old bottles continues in the Western World at the present time.

The objection in Palestine was, that the new wine would burst old bottles, which in those days were of leather. The Western supposition seems to be that bottles of glass will not suffer in that way. None the less, bottle manufacturers and beverage houses are being sued here there and everywhere for injuries sustained from the unexpected breaking of bottles containing carbonated liquids or beer under pressure. It is probable that many of these claims are fabricated, in fact most of them seem to belong in the "racket" class. But it is worth noting that among the bottles alleged to have broken, some have been out in the trade for a couple of years or more, and have probably been refilled many times. How long is a manufacturer expected to be responsible for a bottle after it has left his control?

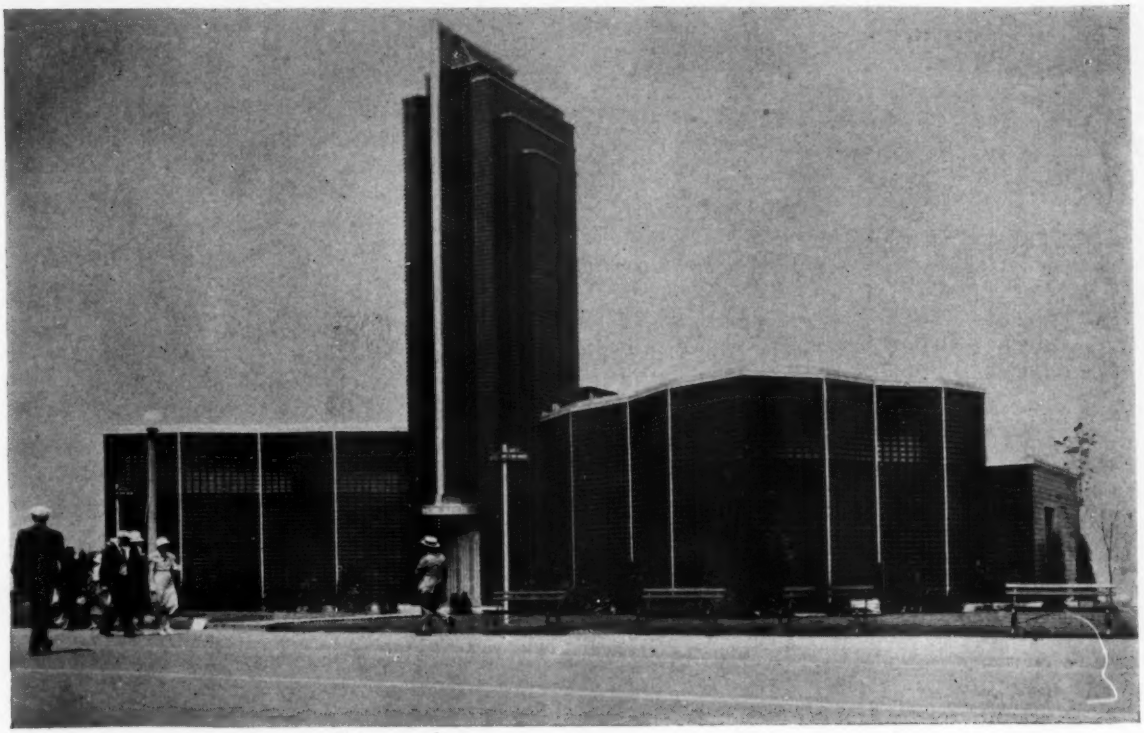
On the sanitary side, the refilling of old bottles is not free from objection. Around the dinner table, cigarette butts are frequently disposed of by dropping them down the necks of emptied bottles. Or a label is rolled around a pencil and poked down inside the bottle. What happens to the bottles in general after they leave the dinner table, what flies and other insects crawl inside to investigate the leavings, has not been fully enquired into.

On the economic side it is doubtful if much is saved or gained by refilling old bottles. New bottles are selling wholesale at something less than two cents apiece. Taking care of bottles and returning them to the brewer or soda manufacturer costs money. Washing and sterilizing them on their return, if accompanied by adequate inspection, costs money. And at the finish one has an inferior bottle, probably more or less bruised, chipped, and doubtfully sanitary.

The proper place for old bottles is in the cullet pile. Then the flies and cockroaches, the bruises and the chips, count for nothing. By the time the bottle has been through the furnace again it will be clean, sound, sanitary and safe.

F. W. PRESTON

Glass Block Building Featured at Century of Progress Fair



AMONG the many interesting exhibits now being shown at the Century of Progress Exposition is a unique structure built of 27,000 colored glass blocks, representing the latest achievement of the Owens-Illinois Glass Company, largest manufacturer of glass containers in the world, who of late have been actively developing new uses for glass, including a new "dustop" glass wool air filter.

These blocks were laid by five men in 12 working days of 8 hours each, an average speed of over 400 blocks per day per man.

This building, 100 feet long and 60 feet wide, surmounted by a tower of colored glass blocks 50 feet high, marks a new era in modern architecture and presages interesting new departures from the past traditions of the building industry.

The glass block is a strong, six-sided building block, of plain surfaces, with a hollow center. It is made by separately pressing a five-sided unit and a lid, then hermetically sealing in the lid as the sixth side, providing an air-tight cavity within each unit. These blocks here, it is stated, withstood exhaustive tests entirely satisfactory to the building profession and when properly reinforced with piping or other stiffening material are capable of sustaining heavy loads.

Any color in the entire gamut of the spectrum is applied to these blocks, giving an immense range to their decorative possibilities. The color is applied to five sides of the flint block, the outer, or weather-surface being left plain. Under certain conditions of lighting interesting triangular shadows play through the wall cast from one unit to another by the blocks themselves. All kinds of pleasing variations in color effect result from changes in lighting conditions from without and within.

This glass-block building at the Exposition makes use of all the colors of the rainbow arranged in blended combination, reds, oranges, yellows, greens, blues and lavenders.

Included in the exhibit of the Owens-Illinois Glass Company, of Toledo, in its glass-block building at A Century of Progress, Chicago, is an elaborate animated model of a complete glass plant in operation. This intricate display was worked out in realistic perspective and with life-like carved models by T. K. Almroth, advertising manager of the company, and built under his supervision

The model is full of color and motion with astonishing lighting effects. It represents the modern bottle manufacturing process and is complete in almost every detail from the arrival and handling of the incoming raw materials to the packing of the finished product. Storage bins, batch car, hoppers, furnace cross section, revolving pot, vacuum machine, conveyors, lehr and inspection, all are realistically represented in miniature.

The machine and pot revolve, miniature bottles are carried by a conveyor into the lehr, where they are seen through a cut-out section moving along toward the inspectors and packers.

Society of Glass Technology

London Section

On Sunday, July 2, about 50 members of the London Section of the Society of Glass Technology and their wives spent an enjoyable day in the counties of Surrey and Sussex with the object of visiting two of the mediaeval glass sites which have recently been discovered.

The party travelled by coach and by private cars to Horsham where they had lunch at the Black Horse Hotel. Here they were introduced to Mr. S. E. Winbolt, M.A. and to Mr. G. H. Kenyon who have been responsible for discovering or rediscovering the mediaeval sites in the district. Their painstaking investigations have added a considerable amount to the knowledge of glassmaking of this period, upon which so little had been known previously.

After lunch Mr. Winbolt briefly described the results of his discoveries and gave the visitors a vivid mental picture of the state of the industry in the 15th and 16th centuries. Mr. B. P. Dudding, M.B.E., A.R.C.Sc., then gave the results of some of the chemical analyses which his colleague, Mr. R. G. Chernside, had carried out on the glass found by Mr. Winbolt. Visitors were also able to inspect a display of specimens which had been arranged for their benefit.

After lunch the party journeyed to the sites of Malham Ashfold, near Loxwood, and Sidney Wood, near Alfold. At each place several of the members were to be seen busily engaged with spades and picks digging for fragments of glass and crucibles.

From every point of view the day, which finished up with tea at the Cranley Hotel, Cranleigh, was a great success. Not only did it give the members of the London Section the opportunity of meeting one another under ideal conditions, but for those who so desired there was every opportunity of increasing their store of knowledge.

In Rochester

The Pfaudler Company, builders of glass-lined steel equipment, reported that their sales have increased "tremendously," necessitating the recalling of its full time staff of employees. In certain departments the Company has been running two and three shifts, filling orders from many of the leading breweries in New York and other States.

In turn, the Pfaudler Company has placed orders with the steel mills for more than 10,000 tons of steel. The Company has been shipping on the average of five carloads of glass-lined tanks to breweries every day since March 1.

From a report Collected by the State Brewers Association by Edward P. Mulrooney, Chairman of the State Alcoholic Beverage Control Board.

Glass Dress Arrives

An evening gown made entirely of glass was recently displayed in a London Department store, having been sent there from Paris. The fabric is spun, not woven, glass, three layers of threads being pressed together. It is about 36 inches wide, and is rolled between layers of tissue paper on cylinders about six inches in diameter.

New Glass Tubing for Illumination Evolved

An innovation of great interest in the construction of glass tubing for neon or other forms of electric-gaseous illumination has recently been perfected by certain Dutch glass manufacturers. For ordinary neon illumination plain glass tubes, flat or circular, are used. The new tubes are are divided internally into two or more longitudinal sections by thin diaphragms of glass. Each compartment being independent and isolated can be filled with suitable gasses of different characters, so that the electrical discharge passing through them produces a series of different colors or shades. To enhance the possibilities of color schemes, the glass of the tube and diaphragms may be tinted, and in some cases the internal divisions are given a helical twist, so that the luminous discharge has a spiral effect.

Owens-Illinois Increases Dividend

The directors of Owens-Illinois Glass Company on July 18 increased its dividend by declaring in addition to the regular dividend of 50c a share on the common stock an extra dividend of 25c a share. Both dividends are payable August 15th to stockholders of record at 3 o'clock P. M. July 30th.

Net earnings of the company and subsidiaries for the twelve months period ended June 30, 1933, were $4,208,-498.98 as compared with $1,830,228.95 for the twelve months period ended June 30, 1932.

Estimated Car Requirements Third Quarter

J. C. Magness, Chairman of the committee reporting on car requirements estimates that 2,350 cars will be required for the third quarter, an increase of 15% over the requirements for the corresponding quarter of 1932. Mr. Magness states: "In explanation of this increase I wish to say that while our business for the 3rd quarter is normally somewhat less than for the 2nd quarter and while our general line of business will be lower this year than last owing to less satisfactory trade conditions, there will be an increase in the total shipments owing to the beer bottle trade and the result of these three factors will be to increase our total requirements for the coming quarter approximately 15% over the corresponding quarter of last year."

Plate Glass Production Still Gaining

The total production of polished plate glass by the member companies of the Plate Glass Manufacturers of America, as reported by Secretary P. A. Hughes, for the month of June 1933 was 9,499,260 sq. ft., as compared to 7,922,434 sq. ft. produced by the same companies in the preceding month, May 1933 and 4,909,988 sq. ft. produced by the Association members in the corresponding month last year, June 1932.

This makes a total of 38,126,348 sq. ft. produced by these companies during the first six months of 1933, as compared to 29,291,919 sq. ft. produced by the Association members during the first six months of 1932.

New Foxboro 2" Indicating Gauge

In answer to industry's persistent demand for a small size, moderately priced Indicating Gauge of guaranteed accuracy and with a full length 270° scale, the Foxboro Company of Foxboro, Mass., has developed a gauge that will be known as the Model "DH". This gauge is so designed that it uses a full length Bourdon spring which results in a reduction in movement multiplication and an increase in inherent accuracy. This little gauge is accurate to within 1% of its total scale and carries the same guarantee as the larger Foxboro Instruments.

The Model "DH" is furnished in a drawn brass case and ring with buffed nickel finish. Buffed brass or chromium finish can also be supplied.. The connection may be either top, bottom, left or right side. Dials may be had either with black background and white block figures, or white background and black figures. The plain, tapered pointer, standard on Foxboro Indicators since 1919, is used. This combination of dial and pointer makes the 2" gauge exceptionally easy to read. Any range from 0-15 lbs. per sq. in., to 0-300 lbs. per sq. in., as well as 0-30" mercury vacuum, can be furnished. The Foxboro Company will be glad to furnish additional information or prices on this gauge.

New Pyrometer

The Mishawaka Industrial Instrument Company, Mishawaka, Ind., have recently put out a new pyrometer, Model 20, as shown in the illustration particularly adaptable to type casting machine, crucible temperatures and similar applications. It is encased in a substantial cast aluminum

case, finished in black enamel. The dimensions of the instrument are 5⅛ inches in height, 4⅝ inches in width, and 2¼ inches in depth. The net weight of the pyrometer is three and one-quarter pounds.

General Electric Company

Orders received by the General Electric Company in the second quarter of 1933, announced by President Gerard Swope, amounted to $35,539,858, compared with $35,304,-070 in the corresponding quarter last year, an increase of about 1 per cent. Orders for the first six months of 1933 amounted to $61,051,502, compared with $68,708,712 for the first half of 1932, a decrease of 11 per cent.

Sales billed for the first six months of 1933 amounted to $61,773,414.19, compared with $80,210,489.15 for the corresponding period last year, a decrease of 23 per cent.

Profit available for common stock for the second quarter of 1933 was $2,471,030.95, equivalent to 9 cents per share, or slightly less than the quarterly dividend of 10 cents per share to be paid on July 25.

The profit available for common stock for the first six months of this year was $4,666,080.69, compared with $7,653,187.61 for the first six months of last year. This profit is equivalent to 16 cents per share for the first six months of 1933 and 27 cents per share for the first six months of 1932 on 28,845,927 shares outstanding in both periods.

New Course Offered

The extension Division of the Brooklyn College offers a new course in the principles of electrochemistry and photochemistry by Dwight K. Alpern, Ph.D. The course will consist of 15 weekly lecture-demonstrations of two hours each, beginning on Friday, September 29, 1933 at 4:10 o'clock, in the Department of Chemistry at 80 Willoughby Street.

This course will consider the principles underlying electrochemical and photochemical processes used in industries, together with methods of manufacturing representative products. The course has been arranged for chemists, engineers, and technical employees, and for teachers of science in the New York City high schools. Fee for the course will be $10.00. Topics to be discussed will include the following: Corrosion of metals, chemical effects of visible and ultraviolet light and X-rays, photovoltaic effects and photoelectric cells, electrode surface effects,—polarization, potential, overvoltage. Applications for admission and further information may be obtained by addressing Professor Joseph G. Cohen, Director of the Extension Division, Brooklyn College, 383 Pearl Street, Brooklyn, N. Y.

Fellowship Renewed

The American Optical Company has renewed its research fellowship in the Department of Ceramics at Rutgers University for the fiscal year 1933-34. This work, which was begun last year involves research on various problems pertaining to optical glass. In addition to his research work the incumbent is permitted to persue graduate studies in the Glass Technology courses of the Ceramics Department.

Current Prices of Glass-Making Materials

as of July 21, 1933.

Quotations furnished by various producers, manufacturers and dealers

Acid	Carlots	Less Carlots
Citric (dom.) lb.	...	.29
Hydrochloric (HCl) 20° tanks Per 100 lb.	...	1.10
Hydrofluoric (HF) 60% (lead carboy) lb.	...	.13½
52% and 48% lb.	.10	.10–.11½
Nitric (HNO_3) 38° carboy ext Per 100 lb.	5.50	...
Sulphuric (H_2SO_4) 66° tank cars ton	15.50	...
Tartaric lb.	... Po. or Gr. .23 / Cry. .23½	
Alcohol, denatured gal.	...	...
Aluminum hydrate ($Al(OH)_3$) lb.	.04–.04½	.05½–.06
Aluminum oxide (Al_2O_3) lb.	.07	.09
Ammonium bifluoride (NH_4FHF) lb.	...	.14¾
Ammonia water (NH_4OH) 26° drums lb.	...	.02¾
Antimony, metallic (Sb) lb.	.02½	.02¾
Antimony oxide (Sb_2O_3) lb.	.07	.07½
Antimony sulphide (Sb_2S_3) lb.	...	.08½
Arsenic trioxide. (As_2O_3) (dense white) 99% lb.	.04	.04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh ton	56.50	...
90% through 100 mesh ton	44.00	...
Barium hydrate ($Ba(OH)_2$) lb.	...	.05¾
Barium mixture, glassmaker's, f. o. b. St. Louis ton	25.00	...
Barium nitrate ($Ba(NO_3)_2$) lb.	...	.07¾
Barium selenite ($BaSeO_3$) lb.	...	...
Barium sulphate, in bags ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f.o.b. shipping point ton	15.00–16.00	18.00
Bone ash, carlots lb.	.06	.06
Borax ($Na_2B_4O_7 10H_2O$) lb.	...	...
Granulated In bags, lb.	.02	.02¼–.02½
Powdered In bags, lb.	.02¼	.02½–.02¾
Boric acid (H_3BO_3) In bags, lb.	.04¼	.04½–.04¾
Cadmium sulphide (CdS)—		
Red lb.	...	.60–.75
Orange lb.	...	.55–.65
Yellow lb.	...	1.30–1.50
Chromium oxide (Cr_2O_3) lb.	...	.18
Cobalt oxide (Co_2O_3)		
In bbls lb.	...	1.15
In 10 lb. tins lb.	...	1.25
Copper oxide		
Red (Cu_2O) lb.	...	.25
Black (CuO) lb.	...	.17–.19
Black prepared lb.	...	.22
Cryolite (Na_3AlF_6) Natural Greenland (Kryolith) lb.	.08½	.09
Synthetic (Artificial) lb.	...	.08
Epsom salts ($MgSO_4$) (imported) technical Per 100 lb.	...	1.50–1.75
Feldspar—		
40 mesh ton	9.50–11.00	...
20 mesh ton	9.50–11.00	...
Granular ton	9.50–11.50	...
Semi-granular ton	9.50–11.00	...
L. C. L., (Min. 2 tons) $2.00 per ton additional plus charge for bags		
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)		
Bulk, carloads, f.o.b. mines ton	30.00	...
In bags or barrels ton	34.00	39.00
Imported ton		
Formaldehyde lb.	...	.07
Graphite (C) lb.	...	.04–.07
Iron oxide—		
Red (Fe_2O_3) lb.	...	.0425
Black (FeO) lb.	.04½	...
Kaolin (f.o.b. mine) ton	8.00–9.00	...
English, lump, f.o.b. New York ton	14.50–25.00	24.50–30.00

Kryolith (see Cryolite)	Carlots	Less Carlots
Lead chromate ($PbCrO_4$) lb.	...	.30
Lead oxide (Pb_3O_4) (red lead) lb.	.070	.080
Litharge (PbO) lb.	.060	.070
Lime—		
Hydrated ($Ca(OH)_2$) (in paper sacks) ton	9.00	...
Burnt (CaO) ground, in bulk ton	6.50	...
Burnt, ground, in paper sacks ton	8.50	...
Burnt, ground, in 280 lb. bbls Per bbl.	2.15	...
Limestone ($CaCO_3$)	1.50–2.50	...
Magnesia (MgO)—		
Calcined, heavy (in bbls.) lb.	.06	.07
light (in bbls.) lb.	...	.23
extra light (in bbls.) lb.	...	.37
Magnesium carbonate ($MgCO_3$) lb.	.06	.10
Manganese 85% (MnO_2) lb.	57.50	60.00
Nickel oxide (Ni_2O_3), black— for nickel content lb.	...	.35
Nickel monoxide (NiO), green— for nickel content lb.	...	.35
Plaster of Paris, bags ton	31.00	23.00–29.00
Potassium bichromate ($K_2Cr_2O_7$)—		
Crystals lb.	.07½	.08
Ground lb.	.08	.08½
Potassium carbonate—94-96% lb.	.0762½	.0825
Calcined (K_2CO_3) 96-98% lb.		
Hydrated 80-85% lb.	.07	.075
Potassium chromate (K_2CrO_4) lb.	...	.25
Potassium hydrate (KOH) (caustic potash) lb.	.07½	.08
Potassium nitrate (KNO_3) (gran.) lb.	...	.06–.06¼
Potassium permanganate ($KMnO_4$) lb.	.17½	.18
Powdered blue lb.	...	.16½–.17
Rochelle salts, bbls lb.	...	.11½
Rouge lb.	... Po. or Gr. / Cry. .12½	
Rutile (TiO_2) powdered, 95% lb.	.15–.20	.20–.25
Salt cake, glassmakers (Na_2SO_4) ton	18.00	...
Selenium (Se) lb.	...	1.70
Silver nitrate (AgNO) (100 oz.) per oz.	...	.28
Soda ash (Na_2CO_3) dense, 58%—		
Bulk, on contract Flat per 100 lb.	1.05	...
In barrels Per 100 lb.	1.38	
In bags Per 100 lb.	1.17½	
Spot orders .025 per 100 lbs. higher	...	...
Sodium bichromate ($Na_2Cr_2O_7$) lb.	.04½	.05
Sodium hydrate (NaOH) (caustic soda) Solid Per 100 lb.	2.50	...
Sodium nitrate ($NaNO_3$)—		
Refined (gran.) in bbls lb.	...	3.62
95 per cent Per 100 lb.	1.245–1.345	1.295–1.395
Sodium selenite (Na_2SeO_3) lb.	...	2.00
Sodium fluosilicate (Na_2SiF_6) lb.	.04½	.05–.06
Sodium uranate (Na_2UO_4) Yellow or Orange lb.	...	1.40–1.45
Sulphur (S)—		
Flowers, in bbls Per 100 lb.	3.45	3.70–4.05
Flowers, in bags Per 100 lb.	3.10	3.35–3.65
Flour, heavy, in bbls Per 100 lb.	2.85	3.20–3.45
Tin chloride ($SnCl_2$) (crystals) lb.	.35½	.36
Tin oxide (SnO_2) in bbls lb.	.28	.29½
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black lb.	...	2.75
Yellow orange lb.	...	1.40
Zinc oxide (ZnO) lb.	.08½	.12
American process, Bags lb.	.05¾	.06
Zircon		
Granular (Milled .005-.02c higher)	.07	.67½–.08
Crude, Gran. (Milled .035-.02c higher)	.03½	.04–.05

Glass Disk Cast by Corning

The Corning Glass Works recently cast a large glass disk, from which will be ground a seventy-six inch telescope mirror for the David Dunlap Observatory at the University of Toronto. The disk weighed two and a half tons, more than twelve inches thick and was one of the largest single castings ever attempted by the concern.

The disk was placed in an annealing oven, after four hours in the mold. It will remain there for four months before it is shipped to England for grinding and polishing.

THE AUDUBON WIRE CLOTH COMPANY, INC., wire cloth and wire products manufacturers of Audubon, N. J., entire business and assets were acquired by the Manganese Steel Forge Co., of Philadelphia, Pa.

The business will be conducted by the Audubon Wire Cloth Corporation, a new organization and wholly owned subsidiary of the Manganese Steel Forge Co.

THE WEST FORK CUT GLASS COMPANY, Weston, W. Va., has recently begun operations. They plan to specialize in factory glassware on contract for chain store organizations.

THE FOOTE MINERAL COMPANY, INC., Philadelphia, Pa., have issued a copy of an original article on the element "Thallium" by Dr. James C. Munch. A free copy of this article will be furnished upon request.

Mosaic Floor Found in Corinth

Professor Richard Stillwell, director of the American School of Classical Studies at Athens and a member of the faculty of the Department of Art and Archaeology of Princeton University, announced recently the discovery of a large mosaic floor found in the ruins of a building bordering the south side of the ancient marketplace of Corinth, Greece.

The mosaic floor is 31 by 24 feet. In a central panel is the figure of an athlete, bearing a palm and standing before the seated figure of Eutychia, the personification of good fortune. Twelve square medallions form a border about this central figure, the corner medallions picturing various birds. The remainder of the mosaic floor is in geometric design.

AMERICAN BOTTLERS OF CARBONATED BEVERAGES will hold their annual convention and exposition in Louisville, Ky., on October 9 to 13. Reservations can be made at the A.B.C.B. Secretary's office, 726 Bond Building, Washington, D. C.

THE ROESSLER & HASSLACHER CHEMICAL COMPANY issue a quarterly price list in the form of a small booklet quoting prices on the many chemicals they sell.

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Amsler-Morton Company, The, Pittsburgh, Pa.
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Amsler-Morton Company, The, Pittsburgh, Pa.
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